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NOTES ON GEOGRAPHIC DISTRIBUTION

Mollusca, Gastropoda, Succineidae, *Omalonyx unguis* (d'Orbigny, 1835): Distribution extension and new records for Brazil

Daniel Coscarelli [1,2] and Teofânia H. D. A. Vidigal [2*]

1 Universidade Federal de Minas Gerais, Instituto de Ciências Biológicas, Departamento de Parasitologia. Avenida Antônio Carlos 6627. CEP 31270-901. Belo Horizonte, MG, Brasil.
2 Universidade Federal de Minas Gerais, Instituto de Ciências Biológicas, Departamento de Zoologia, Laboratório de Malacologia e Sistemática Molecular. Avenida Antônio Carlos 6627. CEP 31270-901. Belo Horizonte, MG, Brasil.
* Corresponding author. E-mail: *teofania.vidigal@gmail.com*

ABSTRACT: *Omalonyx unguis* was previously known to occur in Argentina, Paraguay and Uruguay. We report the first conclusive record of occurrence of this species in Brazil, based on specimens collected in three localities in the Paraguay River sub-basin (Mato Grosso do Sul state – Campo Grande and Miranda; Mato Grosso state – Poconé), and in the Brazilian margin of the Paraná River (Foz do Iguaçu, Paraná State). The species was identified by comparative morphology of the reproductive system, and a map that synthesizes the literature and reports new records is presented.

Omalonyx unguis (d'Orbigny, 1835) is the type species of the genus *Omalonyx* d'Orbigny, 1837, which comprises neotropical succineid slugs. Although this species has been reported from Brazil on different occasions (Moricand 1836; Hidalgo 1870; 1872; Lange de Morretes 1949; Salgado and Coelho 2003; Simone 2006), information from a recent study (Arruda and Thomé 2008) suggests that those reports may be incorrect.

Tillier (1981) conducted an extensive taxonomic study of the genus using samples from most of the South American countries and the Lesser Antilles. In Brazil, he studied animals from the southern, southeastern, northeastern and northern regions, but did not include specimens from the central western region. Tillier (1981) established *O. unguis* as the senior synonym of most of the southern species of *Omalonyx* (*O. convexus* Martens, 1868; *O. patera* Doring, 1873; *O. gallardoi* Hylton-Scott and Lapuente, 1968, *O. weyrauchi* Hylton-Scott, 1970), which resulted in a distribution of *O. unguis* that included Argentina, Paraguay and the southern region of Brazil.

Arruda and Thomé (2008) revalidated the species *O. convexus* and explained that all of the specimens identified as *O. unguis* by Tillier (1981) were, in fact, *O. convexus*, with the exception of the paratype from Paraguay (shell only). The map provided by Arruda and Thomé (2008) shows overlapping distributions of the two species in the Argentinean region of the Parana River Basin and adjacent localities in Uruguay. That map also shows that *O. convexus* extends to Rio Grande do Sul state in southern Brazil; while *O. unguis* extends to the Paraguay River sub-basin in Paraguay. This distributional pattern excluded Brazil from the range of *O. unguis*. Hylton-Scott and Lapuente (1968) also reported *O. unguis* in eight localities, most in Argentina and one in Paraguay. The previously known occurrences of *O. unguis* are summarized in Table 1.

Although there are no consistent records of *O. unguis* occurrence in Brazil, there is no reason to doubt its occurrence in the upper Paraguay River sub-basin of central western Brazil. In fact, this is the only area in Brazil that was not sampled by Tillier (1981). Furthermore, Travassos (1928) used specimens of *Omalonyx* from Mato Grosso state as experimental hosts for a bird trematode, strongly suggesting that *Omalonyx* occurs in that area.

The present investigation uses comparative morphology to establish the first record of *O. unguis* in western Brazil. The occurrence of the genus in this region is thus confirmed, and the known geographical distribution of the species is expanded.

The material studied consists of slugs collected (permits granted by IBAMA [SISBIO] #12113-3) from four localities in western Brazil: Foz do Iguaçu, Paraná state; Campo Grande and Miranda, Mato Grosso do Sul state; and Poconé, Mato Grosso state. All samples were collected from aquatic vegetation on the margins of freshwater systems. One specimen from Miranda is shown in Figure 1. The animals were taken to the laboratory, where they were kept alive until sexual maturity was ascertained by the extrusion of eggs. Mature animals were relaxed overnight in water at 4°C and then killed by immersion in hot water (80°C) for 45 seconds. Shells were removed and stored in dry receptacles, and samples of foot tissue were frozen in an ultra-low temperature freezer (-80°C) for further molecular studies. Bodies were then preserved in Ralliet-Henry solution (5% formaldehyde, 2% acetic acid, 0.6% sodium chloride). All specimens were deposited in the malacological collection of the Laboratório de Malacologia e Sistemática Molecular (LMSM) in the zoology department of the Universidade Federal de Minas Gerais, Brazil.

Reproductive systems were dissected from the preserved bodies and compared with descriptions of anatomical details that are widely used to identify *O. unguis* (Hylton-Scott and Lapuente 1968; Arruda *et al.* 2006; Arruda and Thomé 2008) and other species of the genus (Hylton-Scott and Lapuente 1968; Hylton-Scott 1971; Tillier 1980; 1981).

We examined the following Brazilian material: Paraná

state – Foz do Iguaçu, Refúgio Ecológico Bella Vista, by the margins of the Itaipu Dam, Paraná River, 25°26'49" S, 54°32'58" W (LMSM 3260, 3269; Coscarelli, D. coll.); Mato Grosso do Sul state – Campo Grande, on the *campus* of the Universidade Federal do Mato Grosso do Sul, 20°30'19" S, 54°36'57" W (LMSM 2747; Coscarelli, D. coll.) and Miranda, Fazenda São Francisco, 20°05'56" S, 56°42'34" W (LMSM 2705-08, 2739-42, 2769, 2780-81, 2788, 2795-99, 2898-99, 2900-08, 2911-13, 2917; Coscarelli, D. and Martins, F. I. coll.); Mato Grosso state – Poconé, Transpantaneira Road, 16°22'30" S, 56°40'12" W (LMSM 2673; Coscarelli, D. coll.). The new records of *O. unguis* in Brazil are summarized in Table 2.

The taxonomic characters that we examined matched the diagnosis proposed by Arruda and Thomé (2008), confirming the species identification of the Brazilian specimens as *O. unguis*. That identification was also consistent with the taxonomic information provided by Hylton-Scott and Lapuente (1968) concerning the Argentinean populations of *O. unguis*. The reproductive system, which provides the anatomical features that allow specific identification, is shown in Figure 2. The presence of a serpent-like fold in the surface of the epiphallus (Figure 2D), is the most robust and evident character that is used for the diagnosis of this species.

The presence of *O. unguis* in the material that we examined confirms that the geographical distribution of this species encompasses two hydrological systems in Brazil. The first is the Paraguay River sub-basin, which drains the Pantanal region of western Brazil. The second is the Paraná River where it forms the border between Brazil and Paraguay. These new records extend the range of *O. unguis* northward, and the map in Figure 3 shows the new profile of its distribution.

Figure 1. Live specimen of *Omalonyx unguis* on aquatic vegetation from Fazenda São Francisco, in Miranda, Mato Grosso do Sul State, Brazil. Scale bar = 5 mm. Photo: D. Coscarelli.

Table 1. Previously known occurrences of *Omalonyx unguis*, based on reports in the literature.

COUNTRY	LOCALITY	REFERENCE
Paraguay	Puerto Guarani	Hylton-Scott and Lapuente 1968
Paraguay	Asunción	Arruda and Thomé 2008
Argentina	Partido de Tigre	Arruda and Thomé 2008
Argentina	Rosario	Hylton-Scott and Lapuente 1968
Argentina	Rio Santiago, La Plata	Hylton-Scott and Lapuente 1968; Arruda and Thomé 2008
Argentina	Barca Grande, Delta Del Paraná	Hylton-Scott and Lapuente 1968
Argentina	Guaycolec	Hylton-Scott and Lapuente 1968
Argentina	Manantiales	Hylton-Scott and Lapuente 1968
Argentina	Rio de Oro	Hylton-Scott and Lapuente 1968
Argentina	Formosa	Hylton-Scott and Lapuente 1968; Arruda and Thomé 2008
Argentina	Resistência	Arruda and Thomé 2008
Argentina	Villafañe	Arruda and Thomé 2008
Uruguay	Colonia	Arruda and Thomé 2008

Table 2. New records of *Omalonyx unguis* occurrence in Brazil based on recent field collections. LMSM= Laboratório de Malacologia e Sistemática Molecular, Zoology Department of the Universidade Federal de Minas Gerais, Brazil.

BRAZILIAN STATE	LOCALITY	COLLECTION NUMBER	NUMBER OF DISSECTED ANIMALS
Mato Grosso	Poconé	LMSM 2673	5
Mato Grosso do Sul	Miranda	LMSM 2705-08, 2739-42, 2769, 2780-81, 2788, 2795-99, 2898-99, 2900-08, 2911-13, 2917	36
Mato Grosso do Sul	Campo Grande	LMSM 2747	1
Paraná	Foz do Iguaçu	LMSM 3260, 3269	2

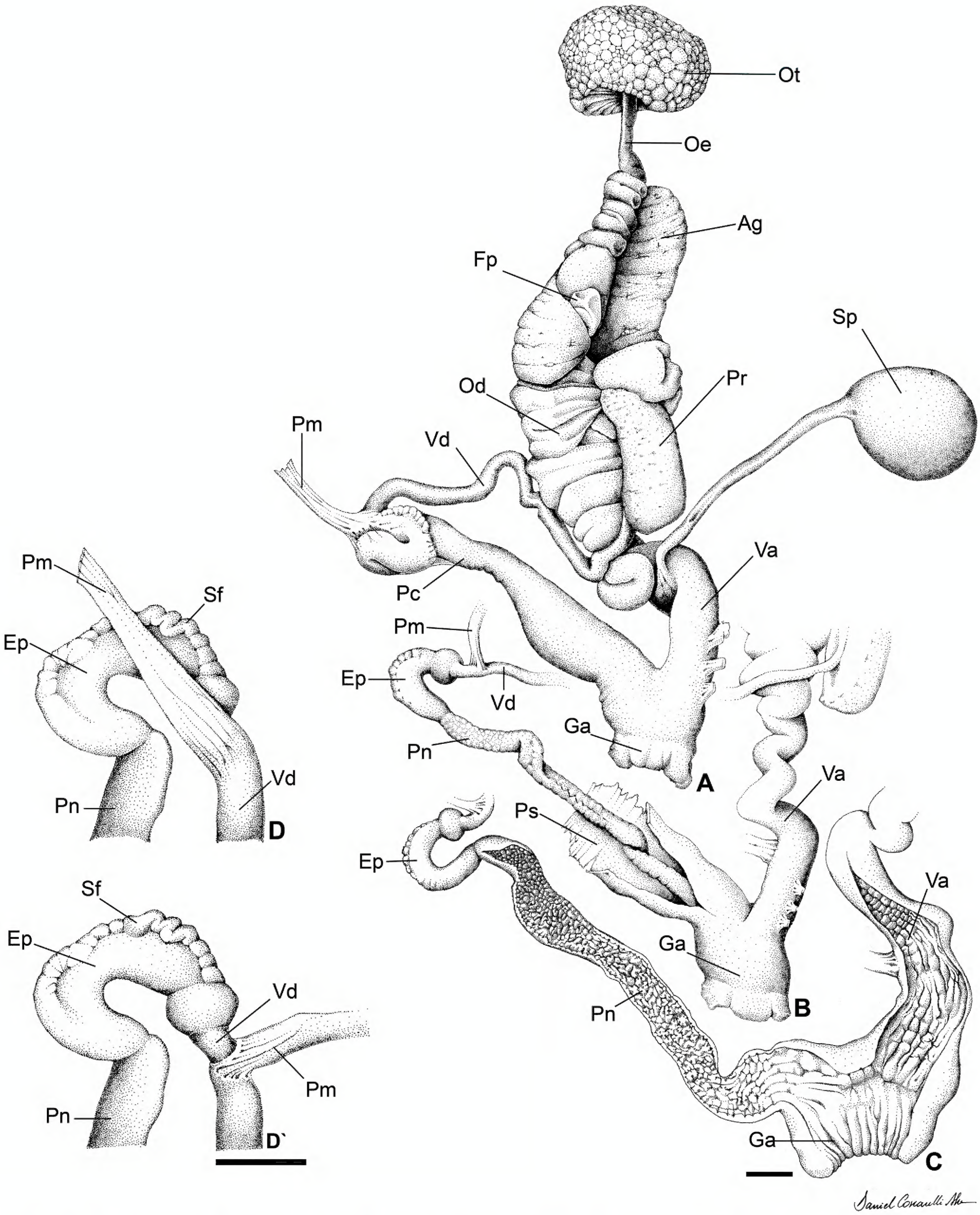

FIGURE 2. Reproductive system of *Omalonyx unguis* from Fazenda São Francisco, in Miranda, Mato Grosso do Sul state, Brazil (LMSM2707). A. General view of the reproductive system, showing taxonomical characters. B. Penial complex extended and penial sheet broken. C. Open penis, showing the folding pattern on the internal surface. Scale bar (A-C) = 1 mm. D. Emphasis on the epiphallic region, showing the distinct serpent-like fold on the external surface and the insertion point of the penial retractor muscle (D. natural position, D'. stretched muscle) in the vas deferens, which characterizes the species. Scale bar = 1 mm. Ag. Albumen gland. Ep. Epiphallus. Fp. Fecundation pouch. Ga. Genital aperture. Od. Oviduct. Oe. Ovulispermiduct. Ot. Ovotestis. Pc. Penial complex. Pm. Penial retractor muscle. Pn. Penis. Pr. Prostate. Ps. Penis sheet. Sf. "Serpent-like" fold. Sp. Spermatheca. Va. Vagina. Vd. Vas deferens. Illustration: D. Coscarelli.

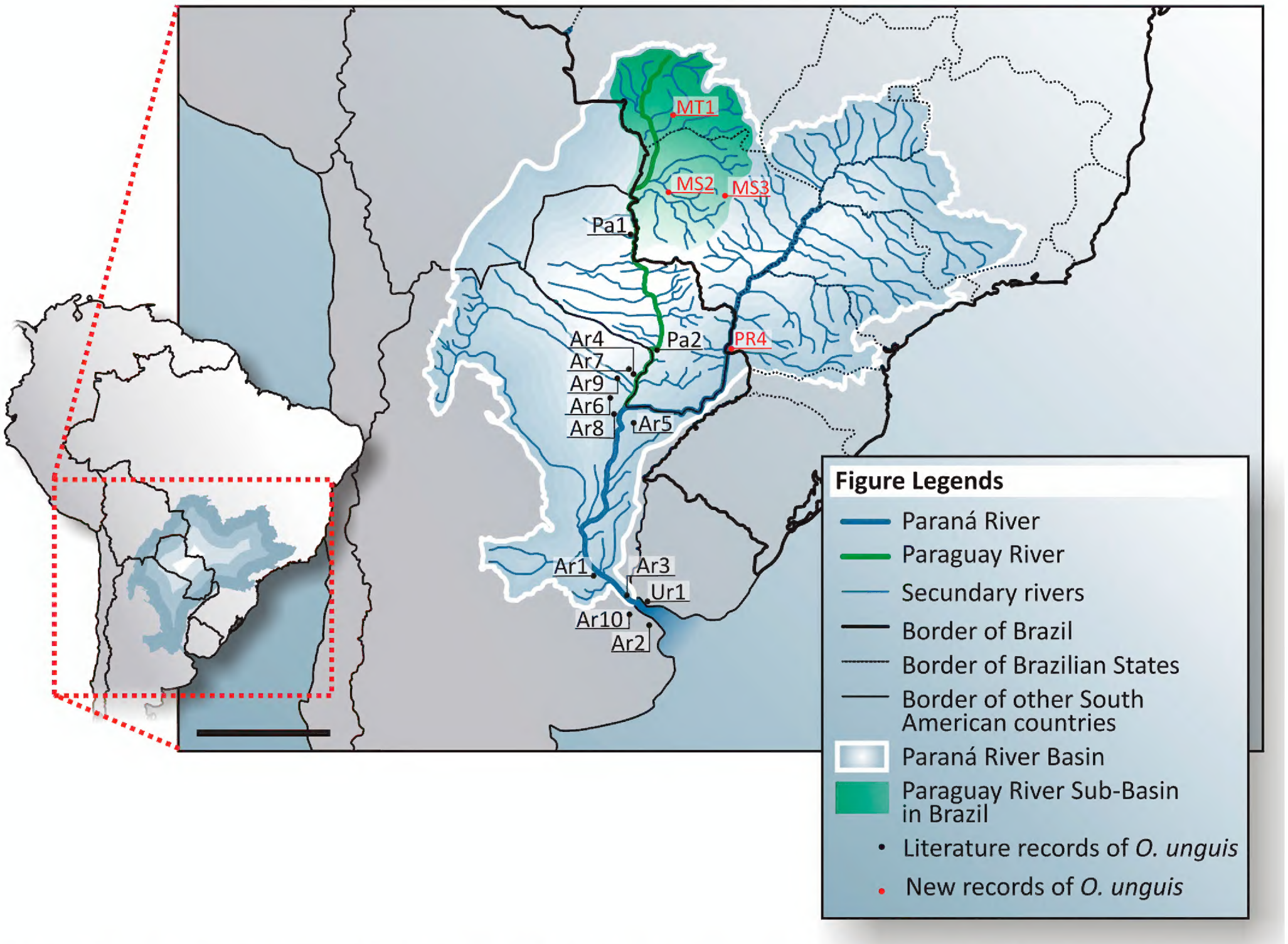

Figure 3. Occureces of *Omalonyx unguis* in South America. The black dots represent previously known as reported by Hylton-Scott and Lapuente (1968) and Arruda and Thomé (2008) and the red dots represent new Brazilian records. Ar = Argentina (Ar1 = Rosario; Ar2 = Rio Santiago, La Plata; Ar3 = Barca Grande, Delta Del Paraná; Ar4 = Guaycolec; Ar5 = Manantiales; Ar6 = Rio de Oro; Ar7 = Formosa; Ar8 = Resistência; Ar9 = Villafañe; Ar10 = Partido de Tigre); MS = Mato Grosso do Sul, Brazil (MS1 = Miranda; MS2 = Campo Grande); MT1 = Poconé, Mato Grosso, Brazil; PA = Paraguay (Pa1 = Puerto Guarani; Pa2 = Asunción); PR1 = Foz do Iguaçu, Paraná, Brazil; Ur1 = Colonia, Uruguay. Scale bar = 1000 km.

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